

Capitalizing on an underground river



A 30-acre site's geology and vast underground water resources suit installation of an open-loop geothermal heat exchange system for the Oregon State Hospital in Junction City. (Hoffman Construction)

When the 220,000-square-foot, 174-bed **Oregon State Hospital** opens Jan. 1, 2015 in Junction City, it will look similar to its 850,000-square-foot cousin in Salem, albeit much smaller. [The new hospital](#) will have one critical difference, however – a geothermal heat exchange system made possible because of the physical makeup of the 30-acre site itself.

“There’s a river underneath there,” said Cade Lawrence, project manager for **Hoffman Construction**, the construction manager-general contractor for both the Junction City and Salem state hospital projects. “We were able to pull that water out from there and use it to convert the heat or cool the air.”

Hoffman first had to fill with rock existing wetlands roughly eight feet deep, down to the water table, Lawrence said. The firm began building vertically in summer 2013, after approval was issued for most of the \$84 million to pay for construction.

The decision to install an open-loop geothermal system for the Junction City hospital came from the abundance of underground water and the fact that the site is spread out, said Jim Sharpe, principal and project manager for the San Francisco office of **Affiliated Engineers**. It designed the mechanical, electrical and plumbing systems for both the Salem and Junction City projects.

“The reason we did it is because of the site,” he said. “It’s just perfect. We couldn’t do it in a lot of places.”

The Salem hospital site, for example, did not have the geography needed, Sharpe said. So, crews in Junction City drilled two test wells to see how the heat exchange system would work.

“It was really to test the underground geography, to see if you can flow water from one end and it would flow back into the ground,” he said. “That test told us the geography was good.”

The water table starts at roughly eight feet beneath the surface and continues down to about 150 feet. Water temperatures at that depth are relatively stable – between 50 degrees and 55 degrees, he said.

The open-loop system, named because the pipes that draw water from the ground and eventually release it back into the earth are not connected, will allow the building to use 40 percent less energy than it would otherwise, Sharpe said.

A more standard, closed-loop system, which Hoffman built at the **Port of Portland**, would have involved 300 to 400 wells being bored into the ground and relied on soil temperatures to heat or cool water passing up through the earth. That would have ultimately raised costs, Sharpe said. Under the open-loop system, only eight wells had to be drilled, he said.

The system, installed by Wilsonville-based **Hydro-Temp Mechanical**, heats and cools the water through six heat recovery chillers, or heat pumps, installed in the building. The water makes its way from the aquifer through pipes to the chillers, which either raise the water temperature to heat the building or lower the temperature to cool the building. The water then moves from one end of the site to the other and is released back into the ground.

The project team toured **Portland State University**'s similar, open-loop geothermal system, which also uses a heat exchanger to extract water from one place and put it back in another, Sharpe said. The main difference is that PSU's well is roughly 800 feet deep and uses the vertical distance to heat or cool water, he said.

"We're using distances horizontally when we put it back in the earth," he said.

At peak usage during summer and winter, respectively, the system will pump between 400 and 800 gallons of water to cool and heat the building.

"You need the underground aquifer and you need the distance," Sharpe said. "You've got to have a good geology – there's got to be good sand and gravel. If there is a lot of clay and rock, you can't suck the water out very easily and it won't want to go back in."

Other sustainable features of the Junction City project include 442 photovoltaic panels installed on the building's roof along with dozens of hydrothermal solar panels to heat water in the building, said Jodie Jones, **Oregon Health Authority**'s administrator on the project.

Once funding was granted in July 2013, Hoffman and its project team accelerated the work by performing much of it off-site. One of its subcontractors, Knife River Corp., precast 256 panel walls at a Harrisburg location about five miles from Junction City.

The walls were on average about 52 feet tall and weighed 70,000 pounds, according to the Oregon Health Authority. When construction started, they were trucked about five miles to the Junction City site, and then lifted and put in place using large cranes, Lawrence said.

"It helped to have our precast ready to roll," Lawrence said. "We went vertical fast and worked with our subs to make the schedule. Everybody did their job."

Oregon State Hospital – Junction City

Construction cost: \$84 million

Construction start date: July 2013

Anticipated completion date: Dec. 31, 2014

Construction manager-general contractor: Hoffman Construction Co.

Architect: HOK, SRG Partnership

Owner's representative: CH2M HILL

Structural engineer: KPFF Consulting Engineers

Civil engineer: Westlake Consultants

MEP: Affiliated Engineers

Landscape: Walker Macy

Other consultants: SOLARC Engineering and Energy + Architectural Consulting